

**Savannah River Site  
Solid Waste Management Department  
Consolidated Incinerator Facility Project  
Operator Training Program**

**WASTE SYSTEMS - WASTE DRAINS (U)**

**Study Guide**

**ZIOITX01.04**

**Revision 2**

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Training Manager / Date

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Engineering / Date

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Facility Manager / Date

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**REVISION LOG**

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REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
1	All	New Issue
2	All	New Issue

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**TABLE OF CONTENTS**

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REVISION LOG .....	3
TABLE OF CONTENTS .....	4
LIST OF TABLES .....	6
LIST OF FIGURES .....	7
REFERENCES.....	8
LEARNING OBJECTIVES .....	9
SYSTEM OVERVIEW.....	11
Safety.....	11
Introduction .....	11
Hazards Associated with Waste Drain System .....	13
SYSTEM PURPOSE .....	14
Waste Drain System Purpose .....	14
Waste Drain Sump Locations.....	14
Summary .....	16
DESCRIPTION AND FLOWPATH.....	17
Introduction .....	17
Tank Farm WDS Flowpath .....	17
CIF Building, Offgas, Ashout, and Stack WDS Flowpath.....	18
MAJOR COMPONENTS .....	20
Introduction .....	20
CIF Building, Ashcrete, Offgas, and Stack Components.....	20
Containment Dikes.....	20
Solid Waste Container Handling Curbed Area .....	20
Ashcrete Processing Enclosure Area/ Ashcrete Container Storage Area.....	20
Stack Area .....	20
CIF Building Area Sump Pump Operation .....	21
CIF Building Area Sumps .....	21
Building and Offgas Sumps/Pumps .....	21
Stack Sump/Pumps.....	22
Ashout Sump/Pumps .....	22

Tank Farm Area WDS Components .....	23
Introduction .....	23
Containment Dikes .....	23
Tank Farm Sumps/Pumps .....	23
Pump Strainers .....	24
Tank Farm Clean Unloading Facility .....	24
Summary .....	25
INSTRUMENTATION .....	26
CONTROLS, INTERLOCKS AND ALARMS .....	27
Interlocks .....	27
Sump and Pump Interlocks .....	27
Tank Farm Interlocks .....	27
Controls .....	28
Limits .....	28
Summary .....	29
SYSTEM INTERRELATIONS .....	30
DCS .....	30
Tank Farm Storage Tanks .....	30
Offgas Storage Tanks .....	30
INTEGRATED PLANT OPERATIONS .....	31
System Startup .....	31
Normal Operations .....	31
System Shutdown .....	31
Abnormal Operations .....	32
Explosions .....	32
Fires .....	33
Nuclear Criticality .....	33
Low-Energy Liquid Releases (LELRs) .....	34
Natural Phenomena .....	34

---

## LIST OF TABLES

---

Table 1 - Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays .....	22
Table 2 - Tank Farm Pump CLIs, Level Switches, Switch Setpoints, and Alarm Point Tag Displays .....	23

LIST OF FIGURES

Figure 1 - CIF Building Sump Locations ..... 12

Figure 2 - Tank Farm Sump Locations..... 16

Figure 3 - Sump Content Normal Destinations ..... 19

Figure 4 - Sump Level Float Switch ..... 25

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5. Drawing W830347, Bldg. 261-H, Ash Removal Unit Process, P&ID, Rev. 59
6. Drawing W830349, Bldg. 261-H, Ashout/Ashcrete System Unit, P&ID, Rev. 2.
7. Drawing W830310, Bldg. 262-H, 200-H Aqueous Waste Tank Process Service, P&ID, Sheets 1 & 2, Rev. 67.
8. Drawing W835649, Bldg. 262-H, 200-H Fuel Oil & Caustic Unloading Process Serv, P&ID, Rev. 26
9. Drawing W2017838, Tank Farm Logic Diagram Sheet 25, Rev. 1
10. Drawing SE5-2-2006175, Tank Farm Logic Diagram Sheet 1, Rev. 1
11. Drawing SE5-2-2006176, Tank Farm Logic Diagram Sheet 2, Rev. 1
12. Drawing SE5-2-2006184, Tank Farm Logic Diagram Sheet 10, Rev. 1
13. Drawing SE5-2-2006257, Bldg. Sump #1 Logic Diagram Sheet 11, Rev. 1
14. Drawing SE5-2-2006258, Bldg. Sump #3 Logic Diagram Sheet 12, Rev. 1
15. Drawing SE5-2-2006259, Bldg. Sump #2 Logic Diagram Sheet 13, Rev. 1
16. Drawing SE5-2-2006261, Stack Sump Logic Diagram Sheet 15, Rev. 1
17. Drawing SE5-2-2006262, Stack Sump Logic Diagram Sheet 16, Rev. 1
18. 261-SOP-WD-01 R, Waste Drain Operations (U), Rev. 6
19. 261-SOP-WTE-01 R, Tank Farm Sampler And Sump Operations (U), Rev. 5
20. 261-AOP-Bldg-01, Stack And Building Sump Events (U), Rev. 0
21. CIF Setpoint Document, Rev. 3
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## LEARNING OBJECTIVES

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### **TERMINAL OBJECTIVE**

- 1.0** Without references, **EXPLAIN** the significance of the Waste Drain System to the Consolidated Incinerator Facility (CIF) operations, including it's importance to safety and the impact on operations of a failure of the system.

### **ENABLING LEARNING OBJECTIVES**

- 1.1** **STATE** the personnel safety concerns associated with the Waste Drain System.
- 1.2** **IDENTIFY** the hazards associated with the Waste Drain System.
- 1.3** **STATE** the purpose of the Waste Drain System.

### **TERMINAL OBJECTIVE**

- 2.0** Using system diagrams, **EVALUATE** potential problems which could interfere with normal Waste Drain System flowpaths to determine their significance on overall system operation and the corrective actions needed to return the system to normal.

### **ENABLING LEARNING OBJECTIVES**

- 2.1** **IDENTIFY** the areas within the CIF that have sumps associated with the Waste Drain System.
- 2.2** **DESCRIBE** how sump contents determine the Waste Drain System flowpaths in the following areas:
  - a. Tank Farm Clean Sump
  - b. Tank Farm Regulated Sump
  - c. CIF Building
  - d. Offgas Area
  - e. Ashout Area
  - f. Stack Area

### **TERMINAL OBJECTIVE**

- 3.0** Given values of the Waste Drain System operating parameters, **EVALUATE** potential problems that could effect the normal functioning of the system or it's components to determine the significance of the existing condition and the actions required to return the system to normal operation.

### **ENABLING LEARNING OBJECTIVES**

- 3.1 DESCRIBE** the following major components of the Waste Drain System including the function, principles of operation, and basic construction:
- a. Containment dikes
  - b. Sump pumps
  - c. Sumps
  - d. Strainers
- 3.2 INTERPRET** the Waste Drain System alarms.
- 3.3 EXPLAIN** the operation of the Waste Drain System interlocks, to include the interlocks actuating conditions, effects, and reasons for the interlocks.
- 3.4 DESCRIBE** the control functions of the Waste Drain System sump pumps.

### **TERMINAL OBJECTIVE**

- 4.0** Given necessary procedures and system conditions, **DETERMINE** the operator actions required for normal and off normal operations of the Waste Drain System including problem recognition and resolution.
- 4.1** Given applicable procedures and plant conditions, **DETERMINE** the actions necessary to perform the following Waste Drain System operations:
- a. System startup
  - b. Normal operation
  - c. System shutdown
  - d. Abnormal operations

## SYSTEM OVERVIEW

<b>ELO 1.1</b>	<b>STATE the personnel safety concerns associated with the Waste Drain System.</b>
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### Safety

Many of the fuels used for incineration are not only chemically toxic but they may present other hazards if they are spill or leak. Personnel should take appropriate measures in dealing with spills and leaks of waste materials. Many corrective measures are addressed through the cognizant procedures; however, Operators should always avoid walking through or in areas where spills or leaks have occurred. There are numerous Eyewatch and Safety Shower stations throughout the facility. They are to be used in the event personnel inadvertently come in contact with a known and/or unknown hazardous substance. Use of any of these stations will alarm in the Control Room alerting Control Room personnel of the need for assistance.

Sump contents could be a splash hazard to personnel. The pH of the contents could be extremely high or low. The contents could be contaminated. Precautions should be observed during sampling and pumping operations.

Operators are routinely called upon to physically lift materials, i.e., portable sump pumps and hoses. Proper lifting techniques and protective gear should be used when performing any lifting.

There are numerous electrically powered components throughout the facility. Proper electrical safety precautions are documented and proceduralized and should be adhered to any time that electrical equipment is being operated or aligned.

### Introduction

Spilled Containment and Collection is available for all areas of CIF. This consists of various sumps, pumps, and high level switches to collect any spill, washwater, or stormwater in the secondary containment. This waste system is comprised of three (3) sub-systems. They are the Waste Tanks and Equipment, Waste Drains, and Waste Ventilation. This lesson will focus on the Waste Drain System (WDS).

The Waste Drain System is used to provide containment or confinement where a chemical hazard exists. This is accomplished through the use of curbed or diked areas constructed to drain to trenches. These trenches in turn drain to various sumps throughout the facility.

The WDS consists of the floor, drainage trenches, and sumps located in the CIF 261-Building and the Tank Farm. There are three (3) Tank Farm Sumps (clean, regulated, and a clean unloading facility sump), and seven (7) CIF Building sumps: an Offgas sump, four CIF Building sumps, a Stack sump and an Ashout sump for containment and collection of spills, rain, and/or wash water. Storm water will be a concern for all areas except Ashout Area and Building Sump #4.

**INFORMATION ONLY** - Engineering and CIF Operations personnel have met to identify the necessary design changes for ensuring CIF sumps meet the regulatory standards for being “empty”. The following changes have been agreed upon.

- The Offgas and Building Sumps 1, 2, and 3 will be modified as follows:
  - The suction pits will be partially filled in with grouting with the resulting surface being sloped to one side.
  - The existing sump pumps will be modified to have the suction leg extended to maximize the volume pumped out of the sump before suction is lost.
  - The low-level pump cut-off feature will be modified to maximize the volume pumped before the suction is lost.
  - Compressed air-operated positive displacement pumps equipped with a flexible suction leg will be rigidly installed and tied into the existing pump discharge line to facilitate heel removal in these sumps.
- The Ashcrete Room Sump will be modified as follows:
  - The sump pump will be modified by removing the strainer and extending the suction leg closer to the floor of the sump.
  - The sump floor will be sloped to one location by applying additional grout to the flat bottom floor.
  - A low-level pump cut-off feature will be modified to maximize the volume pumped before the pump suction is lost.
  - A positive displacement pump will be permanently installed to facilitate heel removal in the sump as the sumps listed above.
- Building Sump #4 has a flat bottom and is not equipped with a pump. It will be modified as follows:
  - The sump floor will be sloped to one location by applying additional grout.
  - A positive displacement pump will be permanently installed to facilitate heel removal in the sump. The discharge of the pump will be routed to Building Sump #3.
  - The pump will be manually operated by an Operator but will be equipped with a low-level cut-off feature when operated in the AUTO position. The Operator will pump the sump dry by manipulating the flexible suction and operating the pump in the MANUAL position.
- The Tank Farm Clean and Regulated Sumps will be modified as follows:
  - The suction pits will be partially filled in with grouting with the resulting surface being sloped to one side.
  - The existing sump pumps will be modified to have the suction leg extended to maximize the volume pumped out of the sump before suction is lost.
  - The low-level pump cut-off feature will be modified to maximize the volume pumped before the suction is lost.
  - Compressed air-operated positive displacement pumps with a flexible suction leg will be rigidly installed and tied into existing pump discharge line to facilitate heel removal.

- The Clean Unloading Area will be modified as follows:
  - The gravity sump will be grouted from the floor to the bottom of the outlet pipe to eliminate any retained liquid in the sump. The liquid will flow to the Tank Farm Clean Sump.
- The Regulated Unloading Area (Rad Oil/Solvent Unloading Sump) will be modified as follows:
  - The suction pits will be partially filled in with grouting with the resulting surface being sloped to one side.
  - The unloading pump, H263-510-04, will be utilized to empty the sump.
  - A flexible suction hose will be provided for complete heel removal of the sump.

<b>ELO 1.2</b>	<b>IDENTIFY the hazards associated with the Waste Drain System.</b>
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### **Hazards Associated with Waste Drain System**

The liquid wastes contained in the sumps may not be compatible. Thus, the sump liquids must be sampled before transferring. For example, the mixing of an acid solution with a basic solution may result in a heat producing chemical reaction. The Chemical Coordinator and the Shift Supervisor must determine if wastes are compatible prior to any transfer operation. The South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.265 Appendix V, *Examples of Potentially Incompatible Waste* provides guidance for liquid waste materials which may be harmful to humans and the environment.

The Environmental Protection Agency (EPA) and South Carolina Department of Health and Environmental Control (SCDHEC) have published regulations requiring the reporting of spills that result of chemicals or hazardous materials including oils and fuels to the environment. In the case of a diked area, materials such as lubricants or fuels can collect in the dike as a result of normal operation. It is not necessary to report these small quantities of materials as a release unless the material is volatile and becomes airborne. However, it is essential that the oil or fuel is not discharged to the sewer system or waterways. One method to prevent discharge of oil or fuel from the sumps to the sewer system or waterways is the use of special pads which selectively pick up on oil type fluids.

A liquid sample must be obtained from the sump and analyzed before determining the destination of the sump contents. Samples from a sump that are classified as "clean" may be pumped to the underground sewer and on to Outfall H-004. The Operator along with the Shift Supervisor decide where to pump the liquid based on the composition of the sump contents. The destination of the "clean" and "unclean" sump contents is discussed in the following sections.

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## **SYSTEM PURPOSE**

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<b>ELO 1.3</b>	<b>STATE the purpose of the Waste Drain System.</b>
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### **Waste Drain System Purpose**

The facility Resource Conservation and Recovery Act (RCRA) permit allows only rainwater, steam condensate, and Service Water that has NOT come in contact with the process to be transferred to the outfall.

The main purpose of the WDS is to provide containment or confinement where a chemical hazard exists. This is accomplished through the use of curbed or diked areas constructed to drain to trenches, which in turn drain to various sumps throughout the facility. The diked areas and sumps may contain contaminated spilled/leaking liquids, tank overflows, rainwater, or wash down.

<b>ELO 2.1</b>	<b>IDENTIFY the areas within the CIF that have sumps associated with the Waste Drain System.</b>
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### **Waste Drain Sump Locations**

There are seven areas at the CIF Building that have sumps - an Offgas sump, Building 1-4 sumps, a Stack sump, and an Ashout sump. The contained liquids can be pumped to the Offgas System Process Tanks, the Aqueous Waste Tank, or pumped to Outfall H-004 dependent upon sump content analysis.

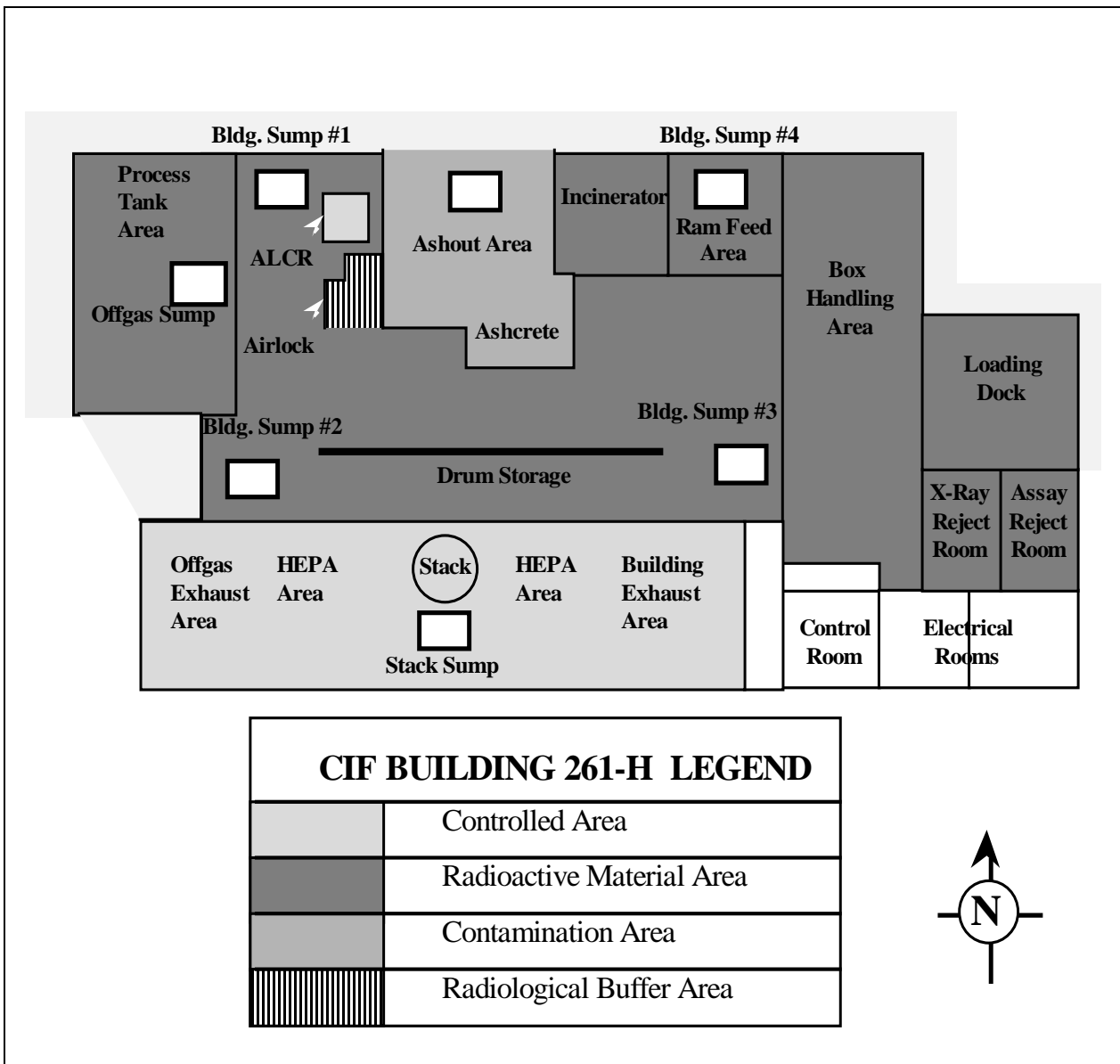
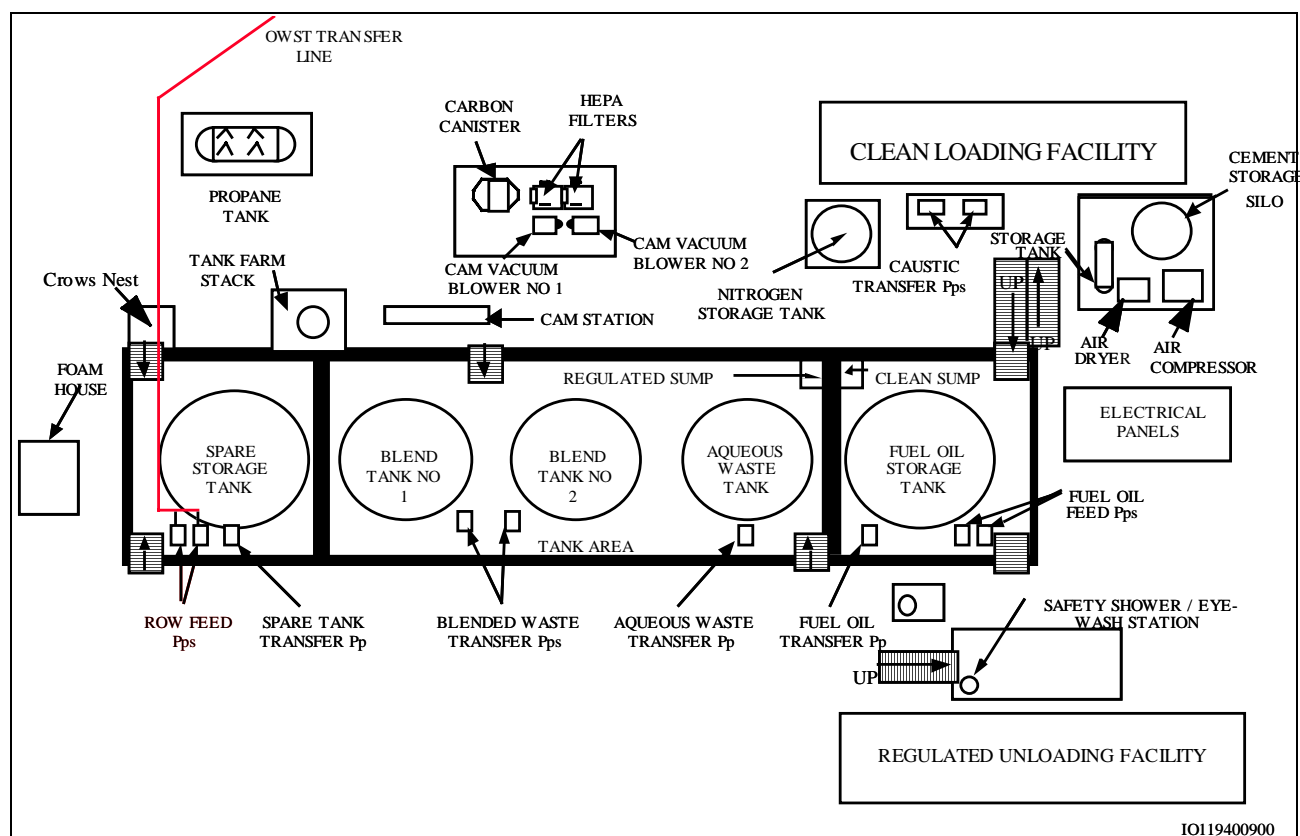


Figure 1 - CIF Building Sump Locations

The Tank Farm is segregated into two areas: a clean and a waste unloading area. The clean area includes a curbed pad for unloading caustic, fuel oil, and cement. The waste unloading area has a curbed pad for unloading tank trucks, carboys, and drums containing liquid wastes. This area is located on the opposite side of the Tank Farm. The liquids are pumped into the waste tanks. Spills or leaks that occur during unloading or storage of waste material will be washed down into the regulated unloading area sump. There are four areas at the Tank Farm with sumps - two diked areas each with a sump, a regulated unloading area sump (Rad Oil Unloading), and a caustic/fuel oil unloading area sump (Clean Unloading Facility). Contained liquids can be pumped to Aqueous Waste Tank or to Outfall H-004 dependent upon the sump content analysis.



**Figure 2 - Tank Farm Sump Locations**

### Summary

- The purpose of the WDS is to provide containment or confinement where a chemical hazard exists and consists of the floor, drainage trenches, and sumps located in the CIF building and the Tank Farm.
- CIF Building area sumps are - Building 1-4, an Off-gas, a Stack, and an Ashout.
- Tank Farm diked area consists of two compartments - a clean unregulated sump and a regulated sump.
- Tank Farm unloading area has two sumps - Rad Oil Unloading area sump and a Clean Unloading Facility sump.

## DESCRIPTION AND FLOWPATH

<b>ELO 2.2</b>	<b>DESCRIBE how sump contents determine the Waste Drain System flowpaths in the following areas:</b> <ul style="list-style-type: none"><li><b>a. Tank Farm Clean Sump</b></li><li><b>b. Tank Farm Regulated Sump</b></li><li><b>c. CIF Building</b></li><li><b>d. Offgas Area</b></li><li><b>e. Ashout Area</b></li><li><b>f. Stack Area</b></li></ul>
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### Introduction

To transfer the sump contents to Outfall H-004, the sample results must be within the acceptable limits listed below:

- Verify no spills or contaminants have been introduced to the sump since the last it was cleaned
- pH must be between 4.8 and 9.0
- Temperature less than 90°F
- No oil sheen visible in the sump or in the sample. Use of special pads to remove oil sheen may be necessary.
- Contamination levels per RCO evaluation are within the following limits: alpha less than 1 dpm/ml and beta-gamma less than 8 dpm/ml
- Total Organic Carbon (TOC) less than 0.8 ppm
- Total Suspended Solids (TSS) less than 20 ppm
- Total Dissolved Solids (TDS) less than 3% by weight.

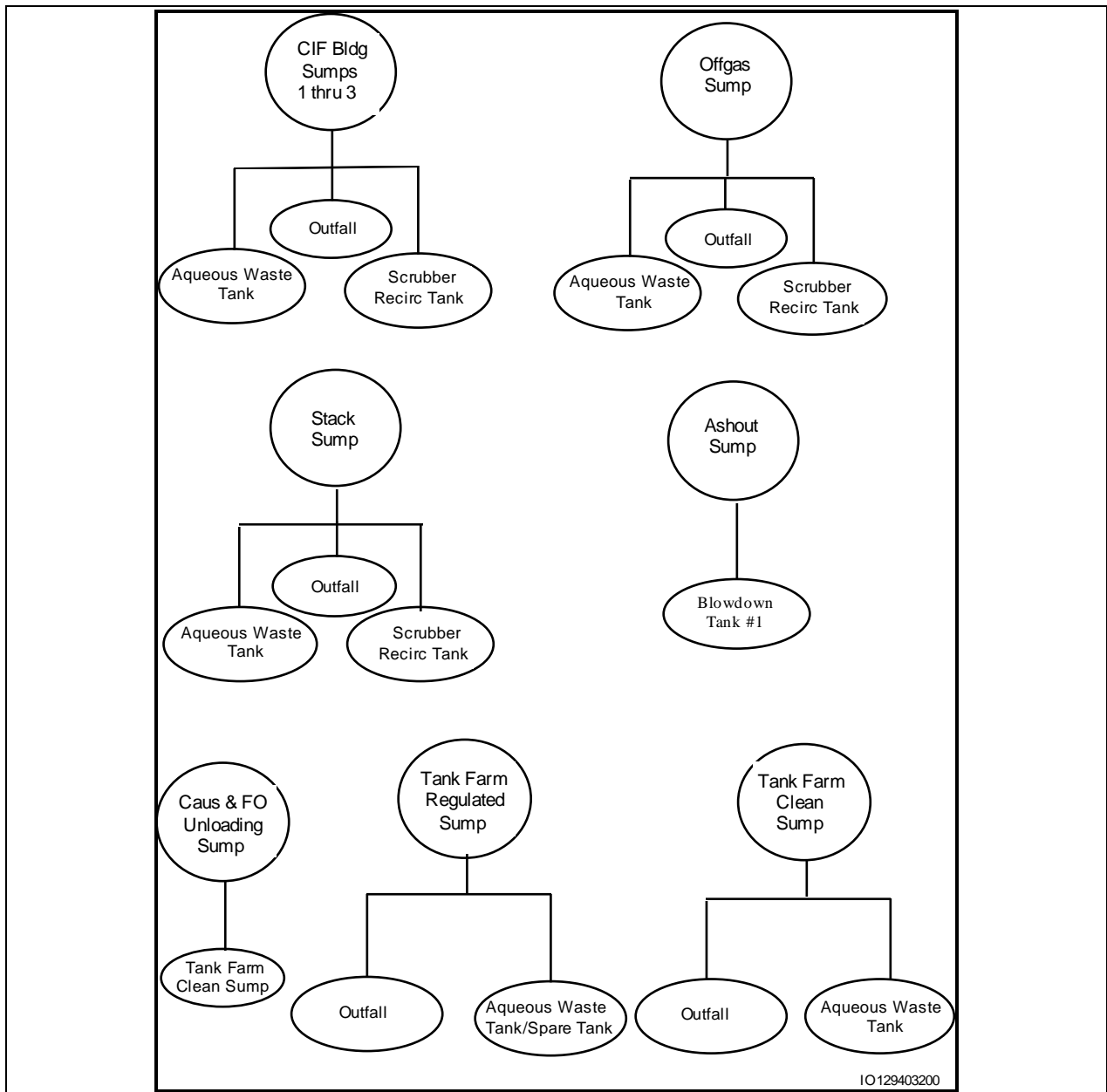
### Tank Farm WDS Flowpath

The Tank Farm diked area is divided into two compartments for clean and regulated effluent. The compartments are separated by a wall that is 6 inches lower than the top of the perimeter walls. (Figure 1, *Tank Farm Sump Flowpath* and Figure 2, *Sump Content Destinations*) The fuel oil storage tank is in the clean compartment and the four waste tanks are in the regulated compartment.

Contaminated effluent in the Tank Farm Regulated Unloading sump can be pumped to the Aqueous Waste Tank or the Spare Tank in preparation for disposal. If the sample from the Tank Farm clean sump is contaminated, it is pumped to the Aqueous Waste Tank. Usually, the liquid in the clean diked area is pumped into the underground sewer system and to Outfall H-004. The Clean Unloading Facility sump utilizes gravity flow to empty into the Tank Farm clean sump.

**CIF Building, Offgas, Ashout, and Stack WDS Flowpath**

If the contents of the CIF Building Sumps, Offgas Sump, and Stack Sump are not contaminated, a manual valve alignment will be performed to pump the liquid to Outfall H-004. If the contents of the CIF Building Sumps, Offgas Sump, and Stack Sump are contaminated, a manual valve alignment will be performed to pump the liquid to the Aqueous Waste Tank or Scrubber Recirculation Tank (Figure 2, *Sump Content Destinations*). The Ashout Sump contents are pumped to the #1 Blowdown Tank. If the sump contents are clean, they can be pumped to the sewer system and on to the outfall.



**Figure 3 - Sump Content Normal Destinations**

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## MAJOR COMPONENTS

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<b>ELO 3.1</b>	<b>DESCRIBE the following major components of the Waste Drain System including the function, principles of operation, and basic construction:</b> <ul style="list-style-type: none"><li><b>a. Containment dikes</b></li><li><b>b. Sump pumps</b></li><li><b>c. Sumps</b></li><li><b>d. Strainers</b></li></ul>
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### **Introduction**

The WDS components are used to collect and transfer liquids from spills, leaking containers, rainwater, and/or wash downs. The WDS is comprised of curbs, trenches, sumps, and pumps which collect and transfer liquid.

### **CIF Building, Ashcrete, Offgas, and Stack Components**

#### **Containment Dikes**

##### **Solid Waste Container Handling Curbed Area**

The curbed area has a surface area of approximately 6,250 square feet. The reject container storage areas adjacent to the solid waste container handling area are approximately 185 square feet each for a total of 370 square feet. The total for the entire area is more than 6,600 square feet. The volume at a depth of 6 inches is approximately 24,700 gallons.

##### **Ashcrete Processing Enclosure Area/ Ashcrete Container Storage Area**

The volume for the storage area including trench and sump is 35,000 gallons at a depth of 6 inches. The maximum volume of containers of liquid that will be stored in the area is 2,640 gallons.

##### **Stack Area**

The Stack Sump is 5 x 5 x 4 feet with a volume of 840 gallons, if allowed to fill up to the steel grating covering the sump.

## **CIF Building Area Sump Pump Operation**

Each CIF Building sump has an installed pump(s) except Building Sump No. 4 which is emptied by a portable pump. A manual valve alignment must be performed to pump the liquid to its destination. A four position flow path selector switch enables the DCS interlocks that will stop the pump, i.e., destination tank has reached high level. The permissive for pump operation is disabled if any of the explosive gas detectors within the CIF are in alarm. The local MOA switch is set to MAN for manual startup or to AUTO for manual startup with automatic stop interlock capability (i.e., sump low level interlock). After MOA selection and the flowpath is selected through the DCS, the Operator starts the pumps with the local push-button start switch. The sump pump will stop automatically when the sump low level indicator switch is activated at a level of 12 inches. When the transfer is complete, the local MOA switch is normally placed in the OFF position. Building Sump No. 4 has no low level switch.

## **CIF Building Area Sumps**

### **Building and Offgas Sumps/Pumps**

All of the CIF Building sumps, Ashcrete sump, Offgas sump, and the Stack sump are 5 x 5 x 4 feet with a volume of approximately 600 gallons. Building sumps 1, 2, & 3 and the Offgas sump have an installed pump with local hand and remote switches. The pumps are vertical, centrifugal pumps with a capacity of 75 gallons per minute (gpm). They have a Service Water supply to the pump bearings, set to maintain a normal operating flowrate of 20 - 40 gph, when the pump is running. The Service Water supply can be determined with a local flowmeter. The Offgas sump pump is fed from MCC-5, Cubicle 5E. The CIF Building sump pumps are fed from MCC-6, Cubicles 6C/6A/6E. Each of the pump's discharge line to the storage tanks is equipped with a strainer to filter large particulate. However, Building Sump No. 4 is emptied by a portable pump.

The Building and the Offgas sump pumps are equipped with a float switches that alarms on the DCS. (Table 1 - *Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays*). The CIF Building and the Offgas sump destination the appropriate point tag display on the DCS in the Control Room. The flowpath is dependent upon the sample analysis results. The local MOA switch is set to MAN for manual startup or to AUTO for manual startup and automatic stop with interlock capability. The sump pump will stop automatically when the sump low level indicator switch is activated if the local MOA switch is in the AUTO position. After the local MOA is positioned and the flowpath selected through the DCS, the sump pump is started by depressing the local pushbutton. When the transfer is complete, the local MOA switch is placed in the OFF position.

## Stack Sump/Pumps

The Stack Sump is expected to have a continuous accumulation of liquid due to condensation within the stack. The sump is provided with two vertical, centrifugal pumps with a capacity of 75 gpm. Stack sump pumps [(H-261-WD-P-5911-(A) and H-261-WD-P-5911-(B)] are fed from MCC-5, Cubicle 3J/5J. The pumps have a service water supply to the pump bearings which is set to maintain a flowrate of 20 - 40 GPH when the pump is running. Flowrate can be determined with a local flowmeter. The pump discharge line to the storage tanks is equipped with a strainer to filter large particulate. The Stack Sump pump operation is the same as the Building and Offgas sump pumps. The Stack Sump is equipped with a float switch (H-261-WD- LSHL-5901) that alarms on the DCS. (Table 1 - *Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays*). After the local MOA is positioned and the flowpath selected through the DCS, the sump pump is started by depressing the local pushbutton. If the alarm does not clear after three (3) minutes of pump operation and the second pump is in AUTO position, the second pump will start if the sump content destination is the Scrubber Recirculation Tanks and the other pump is running. The liquid can be pumped to the Scrubber Recirculation Tank, Aqueous Waste Tank, or Outfall H-004 depending upon the sample analysis.

## Ashout Sump/Pumps

The Ashout Sump Pump is a horizontal, centrifugal, self-priming pump (H-261-WD-P-002) with a capacity of 50 gpm, fed from MCC-4. The Ashout Sump Pump moves liquid through a filter at the discharge end of the pump via a 2 inch diameter line to Blowdown Tank No. 1 and the Outfall. The Ashout Sump is equipped with a float switch (H-261-WD- LSH-6356) that alarms on the DCS. (Table 1 - *Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays*). Ashout sump pump operation is the same as the Building and Offgas sump pumps.

Pump Location	Pump MOA Switch CLI	Pump CLI	Sump Level Switch CLI	Level Switch Setpoints	Point Tag Display
Bldg. Sump #1	H-261-WD-HS-2047-(A)	H-261-WD-P-5914	H-261-WD-LHSL-5902	High - 36 in Low - 5.5 in	WD5914E-1
Bldg. Sump #2	H-261-WD-HS-2054-(A)	H-261-WD-P-5913	H-261-WD-LHSL-5903	High - 36 in Low - 6.75 in	WD5913E-1
Bldg. Sump #3	H-261-WD-HS-2046-(A)	H-261-WD-P-5912	H-261-WD-LHSL-5900	High - 36 in Low - 7.5 in	WD5912E-1
Bldg. Sump #4	No Installed Pump	No Installed Pump	H-261-WD-LHSL-5904	High - 36 in	WD5904LA-1
Offgas Sump	H-261-WD-HS-2048-(A)	H-261-WD-P-5915	H-261-WD-LHSL-5909	High - 36 in Low - 14 in	WD5915E-1
Stack Sump	H-261-WD-HS-2045-(AA) H-261-WD-HS-2045-(BA)	H-261-WD-P-5911-(A) H-261-WD-P-5911-(B)	H-261-WD-LSHL-5901	High - 36 in Low - 3.5 in	WD5911E-1
Ashout Sump	H-261-AH-HS-6361-(A)	H-261-AH-P-6361	H-261-AH-LSH-6356	30 - in	WD6356LA

**Table 1 - Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays**

## **Tank Farm Area WDS Components**

### **Introduction**

The Tank Farm WDS consists of a secondary containment dike, four sumps, and two permanently mounted sump pumps. The six waste storage tanks are considered peripheral components because they contribute to sump liquids through overflow, condensate, and/or contain liquids during a sump content transfer. Because of this, a brief discussion of the purpose of the storage tanks is included in the System Interrelations section.

### **Containment Dikes**

There is a 45,900 gallon volume capacity in the regulated diked area, plus an additional 2,100 gallons in sumps for a total of 48,000 gallons. Total capacity of both regulated and unregulated areas is 62,400 gallons. The containment dike for the fuel oil and waste tanks is divided into clean (unregulated) and regulated sumps. The total surface area is approximately 23 feet 8 inches by 110 feet (approximately 2603.37 square feet). The Aqueous Waste Tank, two Blend Tanks, and a Spare Tank are located in the regulated compartment. The Fuel Oil Tank is located in the clean compartment. The sumps are separated by a wall 6 inches lower than the top of the outer perimeter walls. The total diked area has the capacity to contain the sum of:

- greater than 10 percent of the volume of the largest tank (approx. 12,600 gallons),
- 24 hour maximum rainfall of 6.7 inches,
- 30 minutes of flow from two 500 gpm fire protection pumps (approx. 30,000 gallons), and the vapor suppression foam.

The maximum capacity of the Tank Farm containment area is based on filling the area to a depth of 6 inches.

### **Tank Farm Sumps/Pumps**

Each sump is 5 x 4 x 10 and contains a vertical, centrifugal pump designed for 75 gpm driven by a 5.0 horse power (hp) motor. The clean and regulated sump pumps (H-261-WD-P-0111 and H-261-WD-P-0524, respectively) are fed from MCC-3, Cubicles 2G/5E. Both sump pumps are self-priming centrifugal pumps with capability of 75 GPM. They are equipped with float switches (H-261-WD-LSHL-0107 and H-261-WD-LSHL-0512, respectively) that provide alarms on the DCS. See Table 2 - *Tank Farm Pump CLIs, Level Switches, Switch Setpoints, and Alarm Point Tag Displays*. Normally, the clean sump contents can be pumped to Outfall H-004. The regulated sump is normally pumped to the Aqueous Waste Tank or to the Spare Waste Tank. The flowpath is dependent upon the sample analysis results. If a high level control in the Aqueous Waste Tank or Spare Tank closes the discharge line from the sump pump, the operator will manually stop the pump. The liquid must then be treated as hazardous waste and removed by truck.

The Tank Farm sump pumps are started manually. The local MOA switch is set to MAN for manual startup or to AUTO for manual startup and automatic stop with interlock capability. After the MOA selection and the flowpath selected through the DCS, the Operator starts the pumps with the local push-button start switch. The sump pump will stop automatically when the sump low level indicator switch is activated. When the transfer is complete, the local MOA switch is placed in the OFF position.

Pump Location	Pump Selector Switch CLI	Pump CLI	Sump Level Switch CLI	Level Switch Setpoints	Alarm Point Tag Display
Clean Sump	H-262-WD-HS-0114 Clean Sump Dsch. Selector	H-262-WD-P-0111	H-262-WD-LSH-0107 H-262-WD-LSL-0107	High - 40 in Low - 7.5 in	WD-0107LA
FO & Caustic Unloading Sump	NO PUMP	NO PUMP	H-262-WD-LHSL-0052	High - 4.5 in	WD-0052LA
Reg. Sump	H-262-WD-HS-0525 Reg Sump Selector Switch	H-261-WD-P-0524	H-262-WD-LSH-0512 H-262-WD-LSL-0512	High - 40 in Low - 7.5 in	WD-0512LA
Rad. Oil Unloading Sump	NO PUMP	NO PUMP	H-262-WTE-LHSL-0007	High - 8 in Hi - Hi - 21.0 in	WTE-0007LA

**Table 2 - Tank Farm Pump CLIs, Level Switches, Switch Setpoints, and Alarm Point Tag Displays**

## Pump Strainers

The pumps' discharge line going to the Aqueous Waste and Spare Waste Tanks have duplex strainer baskets. The clean sump strainer is H-261-WD-STR-008 and the regulated sump strainer is H-261-WD-STR-011. Strainers are used to filter out large particulate materials. Each sump pump has a strainer on the discharge line going to the storage tank. However, the lines to the storm sewer do not have strainers. The differential pressure should be checked to be less than 22 psid during pump operation.

The clean and regulated sump pumps are provided with an inlet strainer (H-261-WD-STR-007 and H-261-WD-STR-009, respectively) for protection from large particulates. Discharge lines to the storm sewer leading to the outfall do not have any strainers.

## Tank Farm Clean Unloading Facility

The Tank Farm Caustic Unloading and Fuel Oil Unloading Pump Pad Drain Basin has a sump which gravity drains into the clean sump in the Tank Farm diked area via an underground line. This sump is not equipped with a pump. It is equipped with a float switch (H-261-WD- LSH-0052) that alarms on the DCS.

### **Summary**

- The CIF Building and Tank Farm WDS provides secondary containment for the CIF.
- The WDS consists of an Offgas Sump, four CIF Building Sumps, Stack, Ashout, Clean Unloading Facility, Regulated Unloading Facility and two Tank Farm Sumps.
- Sump content flowpath is dependent upon the sample analysis results. Normally, clean sump contents can be pumped to Outfall H-004 via the sewer system.
- None of the sump pumps will start automatically, except for the second Stack pump, if the interlocks are met. The sump pump local MOA switch is placed in the AUTO position to allow the DCS to stop the pump on an interlock condition or when the low level switch is activated. The Operator starts the pumps with the local push-button start switch.
- Building Sump No. 4 and the Regulated Unloading Sump are emptied by a portable pump.
- The pumps have a service water supply to the pump bearings, set at a flowrate of 20 - 40 GPH when the pump is running.
- The Aqueous Waste Tank, two Blend Tanks, and a Spare Tank are located in the regulated compartment of the Tank Farm. The Fuel Oil Tank is located in the clean compartment.
- Pump strainers are used to filter out large particulate materials. However, the lines to the storm sewer leading to the Outfall do not have strainers.
- The Tank Farm Caustic Unloading and Fuel Oil Unloading Pump Pad Drain Basin has a sump which gravity drains into the clean sump in the Tank Farm diked area.

## INSTRUMENTATION

### ELO 3.2 INTERPRET the Waste Drain System alarms.

The sump level instrumentation is used to provide High and Low level annunciation and for filter pressure differential annunciation to the DCS. Each sump has a high-level alarm that annunciates in the Control Room alerting the Control Room Operator.

The Control Room Operator or Shift Supervisor will dispatch an operator to verify sump level and initiate procedure 261-SOP-WD-01 R, *Waste Drain Operations*, if applicable. Point Tag Displays for the sumps and the sump pumps in the WDS system, are shown in Table 1, *Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays*.

The CIF Building sumps that have level indications use a conductivity-type probe level switch. When the sump level reaches a high level, the circuit makes and a signal is sent to the DCS. When the sump level reaches the low level setpoint, the sump pump stops.

The Tank Farm sump level indicators use a float type switch. When the level reaches the preset level, a float rises and a magnet within the float closes a reed switch sending a signal to the DCS. When level recedes, magnet releases reed switch and alarm clears.

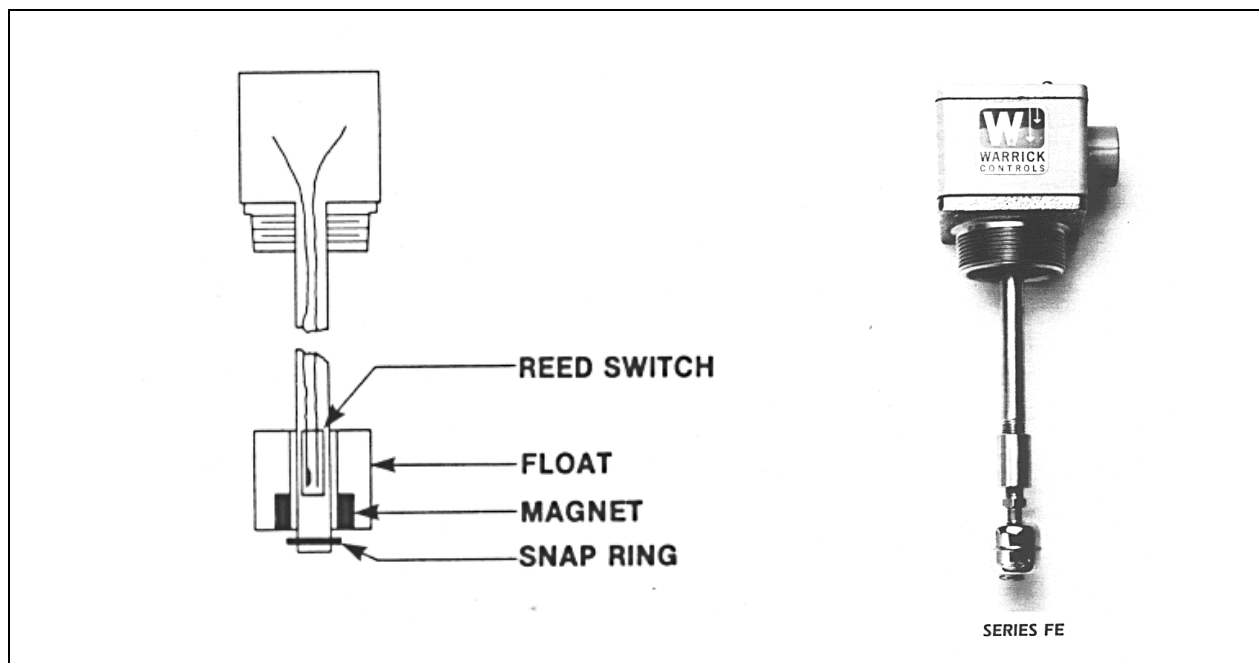


Figure 4 - Sump Level Float Switch

## CONTROLS, INTERLOCKS AND ALARMS

<b>ELO 3.3</b>	<b>EXPLAIN the operation of the Waste Drain System interlocks and reasons for the interlocks.</b>
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### Interlocks

The DCS controls, interlocks, and limits are used for starting and stopping the appropriate sump pumps, controlling the pump discharge destination, and preventing tank overflow by stopping the transfer of liquids to the tank.

#### **Sump and Pump Interlocks**

When the sump High Level setpoint is reached, the High Level alarm will annunciate on the DCS. When the sump Low Level setpoint is reached, the sump pump will turn off to prevent the pump from losing suction and possibly causing pump damage if the pump local MOA switch is in the AUTO position. The permissive for all sump pump operation is disabled if any of the explosive gas detectors within CIF are in alarm.

#### **Tank Farm Interlocks**

The following interlocks play a part in the transfer of sump liquids to the storage tanks:

- When the High Level setpoint of 137 INWC is reached in the Aqueous Waste Storage Tank, an interlock will close the waste loading line by closing valve H-262-WD-FV-0523 from the Clean sump. The interlock can be found on Print #SE5-2-2006175.
- When the High Level setpoint of 137 INWC is reached in the Aqueous Waste Storage Tank, an interlock will close the waste loading line by closing valve H-262-WD-FV-0522 from the Regulated sump. The interlock can be found on Print #SE5-2-2006184.
- When the High Level setpoint of 110 7/8 INWC is reached in the Spare Waste Storage Tank, an interlock will close the waste loading line by closing valve H-262-WD-FV-0529 from the Regulated sump in the loading pipeline to prevent overfilling of the storage tank. This interlock can be found on Print #W2017838.

<b>ELO 3.4</b>	<b>DESCRIBE the control functions of the sump pumps</b>
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## Controls

The majority of the sump pumps at the CIF are operated and controlled by locally mounted MOA Switches and Start Pushbuttons. A four position permissive selector switch is operated on the DCS to open or close the ball valve(s) in the particular line leading to a specific storage tank or the outfall. The positions of the switch are: Aqueous Tank, Spare Tank, Outfall and Off. The selector switch has to be operated in order to perform the receiving tank alignment.

The Stack Sump has two pumps. Normally, both pumps have the local MOA switch in the OFF position. If a high level alarm is initiated to the DCS, a sump pump could start automatically. This will only occur with the following provisions: the second pump MOA switch is in AUTO; the sump content destination is the Scrubber Recirculation Tank; and the alarm stays in for three (3) minutes. Both pumps will run until the low level shutoff point is reached.

## Limits

The limits to the Waste Drain System are as follows:

- After the CIF begins radioactive waste operations, sump content will be considered as radioactive waste. RCO will have to verify contamination levels are within the following limits:
  - alpha is less than 1 dpm/ml, AND
  - beta-gamma is less than 8 dpm/ml.
- Ashcrete Processing Enclosure diked area has a holding capacity of 35,000 gallons.
- Solid Waste Container holding diked area has a capacity of 25,700 gallons (depth of 6 inches).
- Caustic Unloading and Fuel Oil Unloading Pump Pad Drain Basin has a total sump capacity of 2,100 gallons.
- Offgas Sump Pumps have a capacity of 75 GPM.
- Stack Sump has a capacity of 840 gallons.
- Stack Sump pump has a capacity of 75 GPM.
- Ashout Sump has a capacity of 840 gallons.
- Ashout Sump pump has a capacity of 50 GPM.

For WDS sump alarm setpoints see Table 1, *Pump CLIs, Level Switches, Switch Setpoints, and Point Tag Displays*.

### **Summary**

- The Low level signal is provided to prevent pump damage from loss of suction.
- The High level interlock on the Aqueous Waste Tank and Spare Waste Storage Tanks closes the waste loading line to prevent overfilling the tanks.
- Sump pumps are controlled by locally mounted MOA Switches and Start Pushbuttons.
- A four position permissive selector switch is operated on the DCS to open or close the ball valve(s) in the particular line leading to the specific storage tank or outfall.
- Sump pump permissive is disabled when any of the explosive gas detectors are in alarm.

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## **SYSTEM INTERRELATIONS**

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### **DCS**

The DCS controls the startup of the sump pumps using the point tag displays and local MOA switch. It also receives indications for sump high-level alarms and the isolation valves to the storage tanks are controlled by the DCS.

### **Tank Farm Storage Tanks**

The Waste Systems - Waste Drains has six (6) tanks which provide storage for hazardous liquid wastes at the CIF. Four of the six tanks are located within the CIF tank farm area. These tanks will be used to store and blend hazardous waste prior to being fed to the incinerator. The Spare Tank is used to store waste in the event of process upset, a tank leak, or other unplanned events which require additional storage capacity. The two Blend Tanks will be used to receive, store, and blend the high-heat value liquid organic waste (containing low quantities of water). The Aqueous Waste Tank will be used to receive and store the low-heat value wastes. Because of the usually high water content of the sump liquids, most sump contents are transferred to the Aqueous Waste Tank.

### **Offgas Storage Tanks**

The Blowdown Hold Tanks #1 and #2 are located within the Offgas area. These tanks will be used to receive and store the purge or blowdown stream of waste liquid from the Offgas treatment system.

The Stack sump contents are usually transferred to the Scrubber Recirculation Tank. This tank contains scrubber liquids used in the Offgas system and is not considered a hazardous waste tank.

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## INTEGRATED PLANT OPERATIONS

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<b>ELO 4.1</b>	<b>Given applicable procedures and plant conditions, DETERMINE the actions required to perform the following:</b> <ul style="list-style-type: none"><li><b>a. System startup</b></li><li><b>b. Normal operation</b></li><li><b>c. System shutdown</b></li><li><b>d. Abnormal operations</b></li></ul>
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### **System Startup**

Prerequisites for system startup require that the sump contents should be analyzed to determine the destination of the sump liquids.

The Aqueous Waste Tank must not be in service during which time that a transfer is being made into that tank.

All instrumentation associated with the Spare Tank system should be available and in service in accordance with 261-SOP-WTE-02 R, *Spare Tank Operations*.

Level in the Aqueous Waste Tank, Spare Tank, Quench Recirculation Tank, Scrubber Recirculation Tank and Blowdown Tank #1 should be checked to verify adequate space to receive sump liquids.

After the prerequisites have been met, 261-SOP-WD-01 R, *Waste Drain Operations*, will be initiated.

### **Normal Operations**

The sump pumps are operated manually during normal operation due to the uncertain nature of the sump contents. The sump contents must be analyzed to determine their destination. Applicable section(s) of procedure 261-SOP-WD-01 R, *Waste Drain Operations*, is used as a method to operate the Building, Offgas, and Stack Sumps. The Tank Farm WDS is operated in accordance with applicable sections of procedure 261-SOP-WTE-01, *Tank Farm Operations*. Use of these procedures may be directed by a General Operating Procedure or directed by the Shift Supervisor to support existing plant conditions.

### **System Shutdown**

To shutdown the transfer of liquid from one point to another is accomplished in a number of different ways:

- The transfer pump will normally be stopped by the low level switch activation.
- The transfer pump can be stopped by placing local MOA selector switch to OFF.
- Destination routing can be stopped by closing valves via the DCS.

## **Abnormal Operations**

Abnormal operations of the WDS include all events that are not performed on a regular basis and do not imply "something is wrong". Causes of Abnormal Operating Events include failure of the sump pumps, level sensors, level transmitters and alarms, the DCS, strainer blockage, and high level in designated tank to receive sump content. An incinerator shutdown may be required if a sump is not emptied.

An analyses of events that have the potential to produce significant consequences at the CIF has been performed. The following events were analyzed in detail:

- explosions
- fires
- nuclear criticality
- low-energy liquid releases (LELRs)
- natural phenomena.

Each event was analyzed in terms of causes, detection, frequency, effects, consequences, and risks. More details may be found within the WSRC-SA-17, Consolidated Incineration Facility Safety Analysis Report. The source term for the accident analysis is based on the Waste Acceptance Criteria (WAC) identified in the Operational Safety Requirements (OSRs). This section will briefly discuss some of the events in relation to the Waste Drain System.

### **Explosions**

Several factors must be present for an explosion event to occur, including a source of fuel, a source of oxygen or other oxidizing compound, a source of ignition or heat, and an enclosed or semi-enclosed area in which an explosive atmosphere can accumulate.

The presence of sufficient waste material in the dikes or sumps can provide a fuel source. The most probable sources of fuel in the Tank Farm will be from spills during unloading operations. Waste materials spilled on the unloading pads will either drain or be washed down and accumulate in the sump. A vapor cloud will require time and the proper atmospheric conditions to accumulate. It would require approximately 2 hours for an explosive mixture to form in the sump or diked area of sufficient size to create an explosive concern. Accumulation also depends on the weather conditions; vapors will rapidly dissipate on a windy day.

Ignition sources within the diked area could be provided by malfunction of pumps, smoking in the area, or maintenance work being conducted in the area. Outside the diked area, ignition sources could be provided by vehicles, operating equipment, maintenance work, or smoking in violation of the smoking policy. There is also the possibility that two incompatible materials could be spilled during unloading, washed down, and result in an exothermic reaction in the sump.

The primary detection method for spills and leaks is visual identification during normal operations and daily inspections. Secondary detection is provided by the combustible gas detectors located in the Tank Farm. The Continuous Air Monitors (CAMs) are another monitor source. The CAMs would detect unacceptable radiation levels which would be coming from leaks in the waste material transfer lines. However, the CAMs will not detect leaks that are organic in nature only. These monitors would set off an alarm(s) in the Control Room.

## **Fires**

Fire, combustion, or burning requires three constituents:

- fuel (any oxidizable material)
- oxygen (usually air)
- certain temperature (heat from some source).

Fire is the chemical union of oxygen and fuel accompanied by the evolution of thermal energy and is indicated by incandescence or flame. If any one of these three constituents is not present in the proper proportions, no fire exists. If a fire exists and any one of these constituents is sufficiently altered, the fire is extinguished. In its simplest form, all fire control reduces to a manipulation of these three essential constituents.

The primary cause of fire at the CIF can be expected to be welding, electrical shorts, smoking, and friction. Because welding operations are frequently performed in areas not normally subject to open flame, sparks, or hot slag, flammable materials in the vicinity occasionally are ignited. Fires resulting from electrical shorts are usually confined to the equipment in which the fire occurs. This type of fire has been known as a flash fire, which destroys insulating materials and then self-extinguishes. Discarded smoking materials are known to have caused fires. It is expected that a general reduction in smoking will decrease the number of fires that can be attributed to this cause. Materials in contact with rotating equipment or with hot process equipment and lighting can result in a fire. Fires can be detected by automatic detection systems and the occupants of the CIF.

The CIF Fire Risk Assessment (FRA) considers fires within 20 sub-areas of the CIF and estimates the effects and consequences of the fires. The consequences of the fires are: monetary losses; injuries and death of personnel; and dose.

## **Nuclear Criticality**

Since the probability of a nuclear criticality event at the CIF is an incredible event, this topic will not be discussed.

## **Low-Energy Liquid Releases (LELRs)**

An LELR can occur as a result of transfer errors, overflows, chemical addition errors, spills, leaks, or corrosion. Transfer errors are defined as the intentional movement of materials to an unintended location, premature movement, or excessive movement where the potential for chemical reaction is unlikely. These errors are significant operating mistakes because of the high frequency of occurrence and the potential consequence of losing control of large volumes. A secondary effect is vessel overflow, the direct consequence of which is usually small. Transfer errors can be attributed to procedural inaccuracies and human mistakes associated with valve manipulations, piping errors, and premature or excessive transfers. Equipment failures can lead to transfer errors. Transfer errors are detected in processes by liquid-level indicators in vessels and sumps. Operators should observe depletions in vessels from which contents are being transferred and increases in vessels receiving materials. Should discrepancies in depletion or receipt occur, transfers should be stopped until the discrepancies are resolved.

An overflow occurs when the volumetric capacity of a vessel is exceeded. The usual result is a loss of a liquid to the floor, to a sump, to a vent header, or to another vessel. Overflows can be attributed to human errors or mechanical failures. The primary causes of overflows are valving errors, personnel difficulties, instrument failures, equipment failures, process control difficulties, and procedural difficulties. Valving errors are personnel-induced (i.e., operator fails to open or close the proper valve or manipulates valve in the wrong direction). Other personnel difficulties are poor communication or inattention while doing more than one job. Overflows are detected by liquid-level detectors (i.e., High-level detectors monitoring receiving vessels and sumps trigger an alarm in the Control Room when high level is reached) and by operator observation.

## **Natural Phenomena**

Extremes in natural phenomena can adversely affect operations either by damaging the equipment or by aggravating a deteriorating situation. Temperature may have little effect on operations within the building confines. However, temperature can produce significant damage to auxiliary services exposed to the environment. Cold weather can damage or burst lines which may result in sump overflows. Rain may cause overflow of seepage basins and sumps. The effectiveness of personnel is reduced during rain. Routine inspections and maintenance may be limited to essential equipment. Personnel are less likely to follow detailed procedural steps during cold weather or rain.